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PTO/SB/05 (1/98)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	204,231
First Inventor or Application Identifier	Yosef HAIMOVICH
Title	ELECTRONIC FILAMENT NETTING
Express Mail Label No.	EJ339714417US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

1. [X] * Fee Transmittal Form *(e.g., PTO/SB/17)*
(Submit an original, and a duplicate for fee processing)
2. [X] Specification [Total Pages: 7]
(preferred arrangement set forth below)
- Descriptive title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Bnef Description of the Drawings *(if filed)*
- Detailed Description
- Claim(s)
- Abstract of the Disclosure
3. [X] Drawing(s) *(35 U.S.C. 113)* [Total Sheets: 4]
4. Oath or Declaration [Total Pages: 2]
   a. [X] Newly executed (original or copy)
   b. [ ] Copy from a prior application (37 C.F.R. § 1.63(d))
   (for continuation/divisional with Box 17 completed)
   [Note Box 5 below]
   i. [ ] DELETION OF INVENTOR(S)
   Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).
5. [ ] Incorporation By Reference *(useable if Box 4b is checked)*
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered to be part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. [ ] Microfiche Computer Program *(Appendix)*
7. Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
   a. [ ] Computer Readable Copy
   b. [ ] Paper Copy (identical to computer copy)
   c. [ ] Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. [X] Assignment Papers (cover sheet & document(s))
9. [ ] 37 C.F.R.§3.73(b) Statement *(when there is an assignee)* [XX] Power of Attorney
10. [ ] English Translation Document *(if applicable)*
11. [ ] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
12. [ ] Preliminary Amendment
13. [X] Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
14. [X] * Small Entity Statement(s) *(PTO/SB/09-12)* [ ] Statement filed in prior application, Status still proper and desired
15. [ ] Certified Copy of Priority Document(s)
(if foreign priority is claimed)
16. [ ] Other: _____

* *A new statement is required to be entitled to pay small entity fees, except where one has been filed in a prior application and is being relied upon.*

17. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in a preliminary amendment:*
[ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No: _____ / _____

Prior application information: Examiner _____ *Group / Art Unit:* _____

18. CORRESPONDENCE ADDRESS

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Name (Print/Type)	Stewart J. Fried	Registration No. (Attorney/Agent)	20,694
Signature		Date	Aug. 30, 1999

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3497

Applicant or Patentee: _____ Attorneys Docket No.: 204,231
Serial or Patent No.: _____
Filed or Issued: _____
For: _____

VERIFIED STATEMENT [DECLARATION] CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27(c)) - SMALL BUSINESS CONCERN

I hereby declare that I am

[ ] the owner of the small business concern identified below;
[X] an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN HI-G-TEK LTD.
ADDRESS OF CONCERN 16 Hacharoshet Street, Or-Yehuda 60375, Israel

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.
I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention entitled ELECTRONIC FILAMENT NETTING, by inventor(s) Yosef Haimovich, Yehuda Armoni and Michael Auerbach described in

[X] the specification filed herewith
[ ] application serial no._____, filed _____
[ ] patent no. _____, issued _____

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(d) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(c). *NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averting to their status as small entities. (37CFR 1.27).

FULL NAME _____
ADDRESS _____
[ ] INDIVIDUAL [ ] SMALL BUSINESS CONCERN [ ] NONPROFIT ORGANIZATION

FULL NAME _____
ADDRESS _____
[ ] INDIVIDUAL [ ] SMALL BUSINESS CONCERN [ ] NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR {1.28(b)).
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING X HAIMOVICH YOSEF
TITLE OF PERSON OTHER THAN OWNER X V.P R&D
ADDRESS OF PERSON SIGNING X 15 SMILANSKY ST RISHON LEZION

SIGNATURE X Yosi DATE X 4/8/99

34797usa.doc 25-Jul-99

ELECTRONIC FILAMENT NETTING

FIELD OF THE INVENTION

The present invention relates generally to security nets and meshes and particularly to an electronic security net or mesh for placing around cargo and the like.

BACKGROUND OF THE INVENTION

It is essential to protect cargo, freighted by ship, air, rails or truck, from tampering and theft. Valuable cargo passing through freight terminals is prone to attempts by unscrupulous persons to open the cargo and pilfer the contents. Thus there is a well established need for simple and efficient apparatus for monitoring cargo and alerting of attempts to tamper with or steal the contents.

SUMMARY OF THE INVENTION

The present invention seeks to provide simple and efficient apparatus for monitoring cargo and alerting of attempts to tamper with or steal the contents. The present invention provides an electronic filament netting which includes electrical monitoring apparatus. The netting is draped over the object to be protected and any attempt to tamper with the netting causes a change in an initial electrical parameter, which change is communicated to the electronic monitoring apparatus which can then actuate an alarm.

There is thus provided in accordance with a preferred embodiment of the present invention an electronic filament netting including a warp of a first plurality of wires woven together with a weft of a second plurality of wires, wherein a random number of the warp and the weft wires are electrically connected to electronic monitoring apparatus so as to create a random electrical connection which defines an initial electrical parameter, wherein a change in the initial electrical parameter is communicated to the electronic monitoring apparatus.

In accordance with a preferred embodiment of the present invention the warp and the weft wires are electrically connected in a random manner to a bus in electrical communication with the electronic monitoring apparatus.

Further in accordance with a preferred embodiment of the present invention the warp and the weft wires are embedded in a material suitable for draping over an object to be protected.

Still further in accordance with a preferred embodiment of the present invention the warp and the weft wires are pre-manufactured in random electrical connection with the bus.

Additionally in accordance with a preferred embodiment of the present invention the bus is attached to an object to be protected.

In accordance with a preferred embodiment of the present invention at a junction between one of the warp wires and one of the weft wires, either one of the warp wires or weft wires is looped around the other wire.

Further in accordance with a preferred embodiment of the present invention the warp and the weft wires include electrically resistive elements.

Still further in accordance with a preferred embodiment of the present invention at least one of the warp and the weft wires includes a multiplicity of resistive wires, wherein only a random number of the resistive wires are electrically connected to an electrical terminal of the electronic monitoring apparatus.

Additionally in accordance with a preferred embodiment of the present invention the electronic monitoring apparatus includes a multiplexer to which are electrically connected the warp and the weft wires.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description, taken in conjunction with the drawings in which:

Figs. 1 and 2 are simplified block diagrams of an electronic filament netting constructed and operative in accordance with a preferred embodiment of the present invention;

Fig. 3 is a simplified illustration of warp and weft wires looped around each other in the electronic filament netting of Fig. 1;

Figs. 4 and 5 are simplified illustrations of the electronic filament netting of Fig. 1 placed around airplane cargo; and

Fig. 6 is a simplified illustration of the electronic filament netting of Fig. 1 placed around truck cargo.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Reference is now made to Figs. 1 and 2 which illustrate in block diagram form an electronic filament netting 10. Netting 10 preferably includes a warp of a first plurality of wires 12 woven together with a weft of a second plurality of wires 14, wherein a random

number of warp and weft wires 12 and 14 are electrically connected to electronic monitoring apparatus 16.

Preferably the random connection is accomplished by electrically connecting the warp and weft wires 12 and 14 in a random manner to a bus 18 in electrical communication with electronic monitoring apparatus 16. Bus 18 is preferably simply an electrically conductive wire, although other constructions of busses may be employed as well.

Warp and weft wires 12 and 14 may be draped as is over an object to be protected, or alternatively, may be embedded in a material 20, such as a cloth or tarpaulin, suitable for draping over the object to be protected. Warp and weft wires 12 and 14 may be pre-manufactured in random electrical connection with bus 18, in which case bus 18 is preferably embedded in material 20 as well. Alternatively, bus 18 itself is attached to the object to be protected. For example, a cargo palette may be manufactured or reworked to have bus 18 embedded therein. After placing netting 10 over the object to be protected, the ends of warp and weft wires 12 and 14 may then be randomly attached to bus 18. In any case, the random electrical connection defines an initial electrical parameter, such as resistance, capacitance or inductance, for example, and a change in the initial electrical parameter is communicated to electronic monitoring apparatus 16 for monitoring and alerting of any attempt of tampering or theft.

Electronic monitoring apparatus 16 preferably includes, *inter alia*, a multiplexer 22 (ends of the wires being preferably connected to terminals of multiplexer 22), which operates in conjunction with an analog-to-digital converter 24. Preferably one multiplexer is provided for the warp and another for the weft. Electronic monitoring apparatus 16 polls the wires via multiplexers 22 and checks if there has been any change in the initial electrical parameter. Any change detected actuates alarm apparatus to alert of possible tampering. Data relating to the electrical parameter may be sent via the A-D converters 24 as a digital value to a remote monitoring station, such as a station 26 shown in Fig. 5, which is in either wired or wireless communication with electronic monitoring apparatus 16. Suitable controllers may be provided for controlling any portion of electronic monitoring apparatus 16.

In accordance with a preferred embodiment of the present invention, in order to enhance security, electronic monitoring apparatus 16 communicates with monitoring station 26 in an encrypted manner. For example, well known encryption algorithms, such as RC-5, DES or DVB, may be employed. To provide an even greater level of trust, mutual zero-knowledge interaction authentication sessions between electronic monitoring apparatus 16 and monitoring

station 26 may be held, such as the so-called Fiat-Shamir authentication methods taught in US Patent 4,748,668 to Shamir and Fiat, the disclosure of which is incorporated herein by reference.

Referring now to Fig. 3, it is seen that preferably that at a junction between one or more of warp wires 12 and weft wires 14, either one of the wires is looped around the other wire. This arrangement ensures that the wires cannot be lifted away from the object to be protected without changing the electrical parameter and thus ensures that the alarm apparatus will be alerted. The skilled artisan will appreciate that warp wires 12 and weft wires 14 may be arranged in other manners to achieve this goal.

The circuitry comprising wires 12 and 14, electronic monitoring apparatus 16 and bus 18, is preferably constructed in accordance with the teachings of U.S. Patent Application No. 08/815,389, the disclosure of which is incorporated herein by reference. As such, warp and weft wires 12 and 14 may be electrically resistive elements. Warp and weft wires 12 and 14 may include a multiplicity of resistive wires, wherein only a random number of the resistive wires are electrically connected to an electrical terminal of electronic monitoring apparatus 16. As described in U.S. Patent Application No. 08/815,389, the wires 12 and 14 would in this case be preferably constructed of a high resistivity material such as nickel chrome. Each wire is preferably insulated from each other and from the external world. The random connection of the wires to electronic monitoring apparatus 16 results in a statistically random electrical resistance, which resistance cannot be measured from outside netting 10. Alternatively, warp and weft wires 12 and 14 may be electrically inductive or capacitive elements. As another alternative, warp and weft wires 12 and 14 may be frangible elements which when broken alert of a change in the initial electrical parameter.

Referring to Figs. 4, 5 and 6, it is seen that electronic filament netting 10 may be placed around airplane cargo 28 (Figs. 1 and 2) and truck cargo 30 (Fig. 6).

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described hereinabove. Rather the scope of the present invention includes both combinations and subcombinations of the features described hereinabove as well as modifications and variations thereof which would occur to a person of skill in the art upon reading the foregoing description and which are not in the prior art.

CLAIMS

What is claimed is:

1. An electronic filament netting comprising:

a warp of a first plurality of wires woven together with a weft of a second plurality of wires, wherein a random number of said warp and said weft wires are electrically connected to electronic monitoring apparatus so as to create a random electrical connection which defines an initial electrical parameter, wherein a change in said initial electrical parameter is communicated to said electronic monitoring apparatus.

2. The electronic filament netting according to claim 1 wherein said warp and said weft wires are electrically connected in a random manner to a bus in electrical communication with said electronic monitoring apparatus.

3. The electronic filament netting according to claim 1 wherein said warp and said weft wires are embedded in a material suitable for draping over an object to be protected.

4. The electronic filament netting according to claim 2 wherein said warp and said weft wires are pre-manufactured in random electrical connection with said bus.

5. The electronic filament netting according to claim 2 wherein said bus is attached to an object to be protected.

6. The netting according to claim 1 wherein at a junction between one of said warp wires and one of said weft wires, said one of said warp wires is looped around said one of said weft wires.

7. The netting according to claim 1 wherein at a junction between one of said warp wires and one of said weft wires, said one of said weft wires is looped around said one of said warp wires.

8. The netting according to claim 1 wherein said warp and said weft wires comprise electrically resistive elements.

9. The netting according to claim 1 wherein said warp and said weft wires comprise electrically capacitive elements.

10. The netting according to claim 1 wherein said warp and said weft wires comprise electrically inductive elements.

11. The netting according to claim 1 wherein at least one of said warp and said weft wires comprises a multiplicity of resistive wires, wherein only a random number of said resistive wires are electrically connected to an electrical terminal of said electronic monitoring apparatus.

12. The netting according to claim 1 wherein said electronic monitoring apparatus comprises a multiplexer to which are electrically connected said warp and said weft wires.

13. The netting according to claim 1 and further comprising a monitoring station in communication with said electronic monitoring apparatus.

14. The netting according to claim 13 wherein said monitoring station is in encrypted communication with said electronic monitoring apparatus.

15. The netting according to claim 14 wherein said encrypted communication comprises a mutual zero-knowledge interaction authentication session.

ABSTRACT OF THE DISCLOSURE

An electronic filament netting including a warp of a first plurality of wires woven together with a weft of a second plurality of wires, wherein a random number of the warp and the weft wires are electrically connected to electronic monitoring apparatus so as to create a random electrical connection which defines an initial electrical parameter, wherein a change in the initial electrical parameter is communicated to the electronic monitoring apparatus.

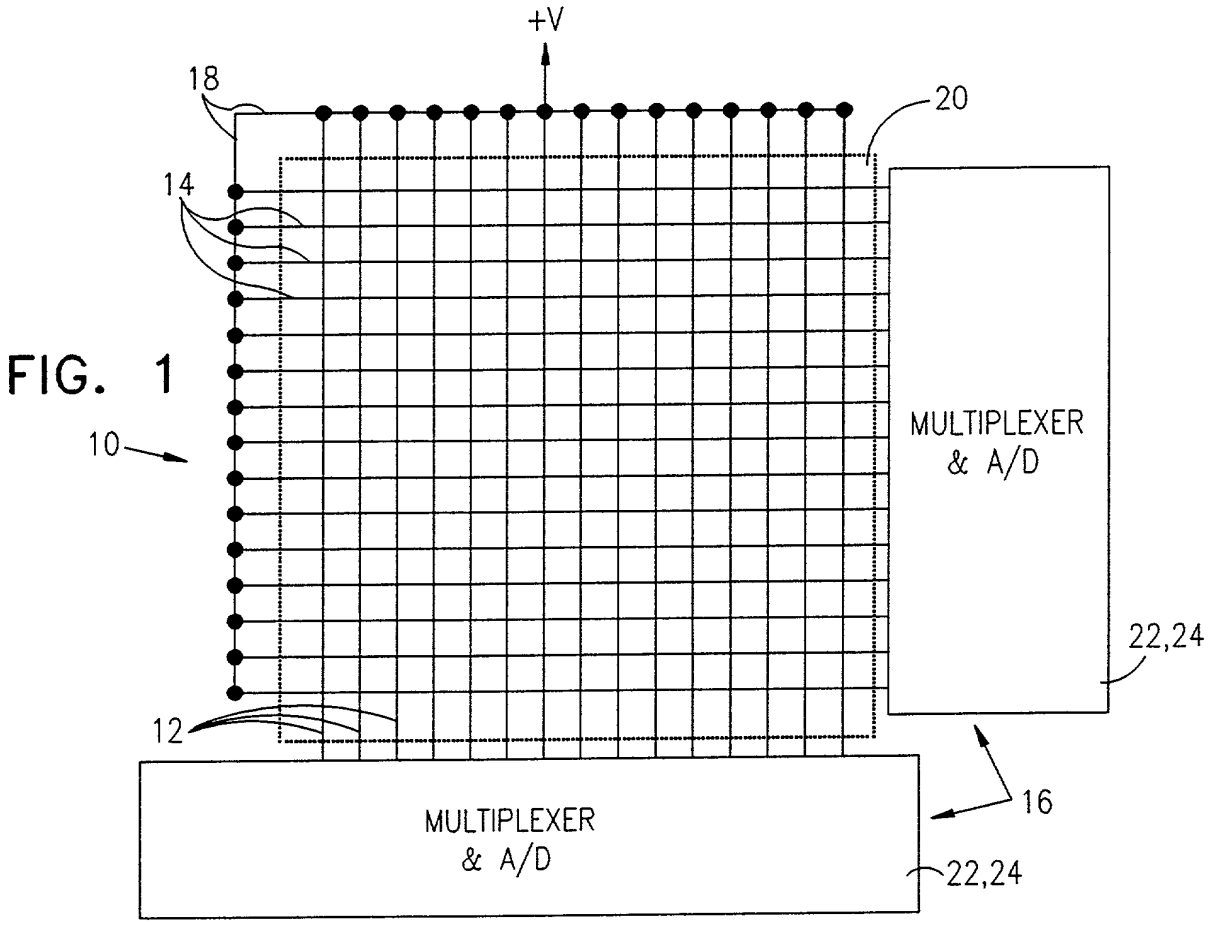

+V
18
20
14
MULTIPLEXER
& A/D
22,24
10
12
16
MULTIPLEXER
& A/D
22,24

FIG. 1

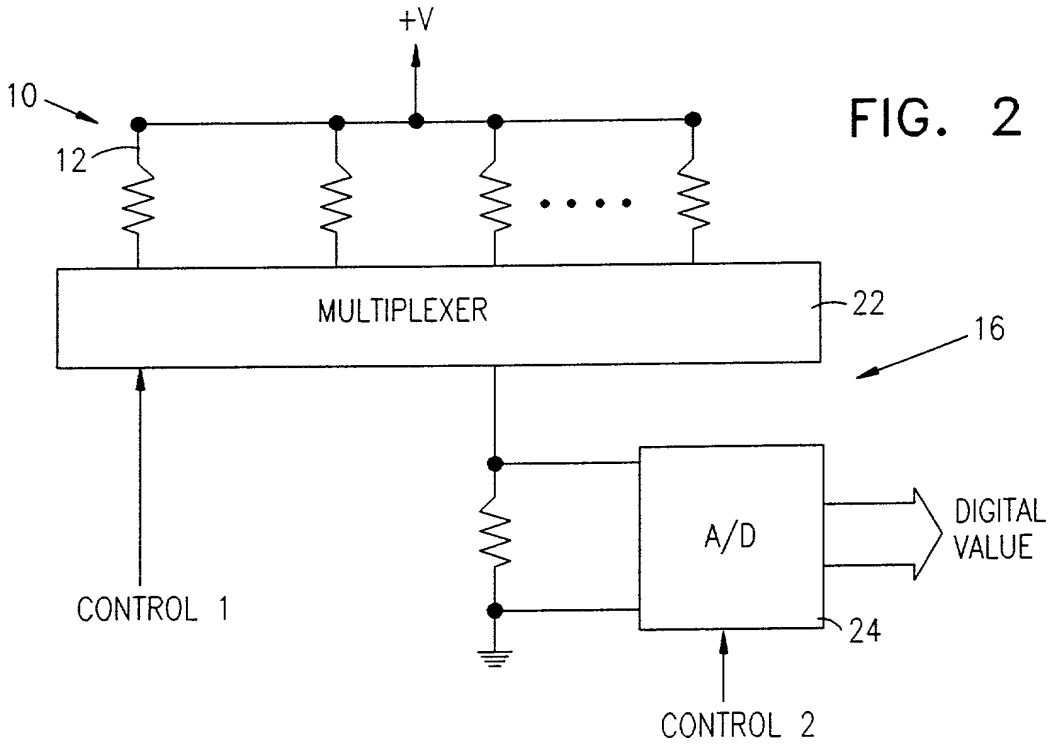
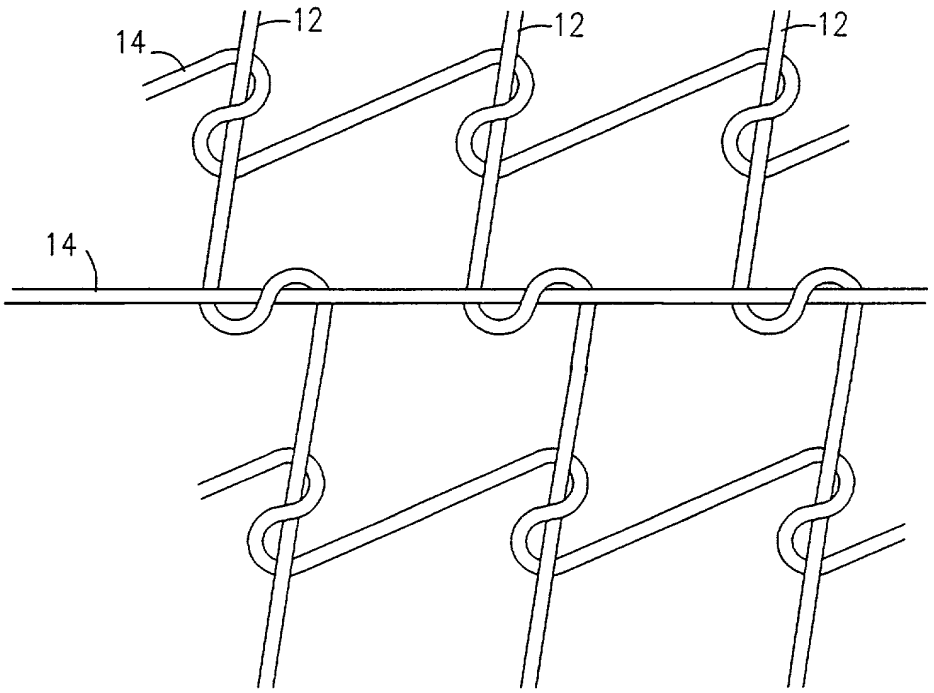

+V
10
12
MULTIPLEXER
22
16
A/D
DIGITAL
VALUE
24
CONTROL 1
CONTROL 2

FIG. 2

FIG. 3



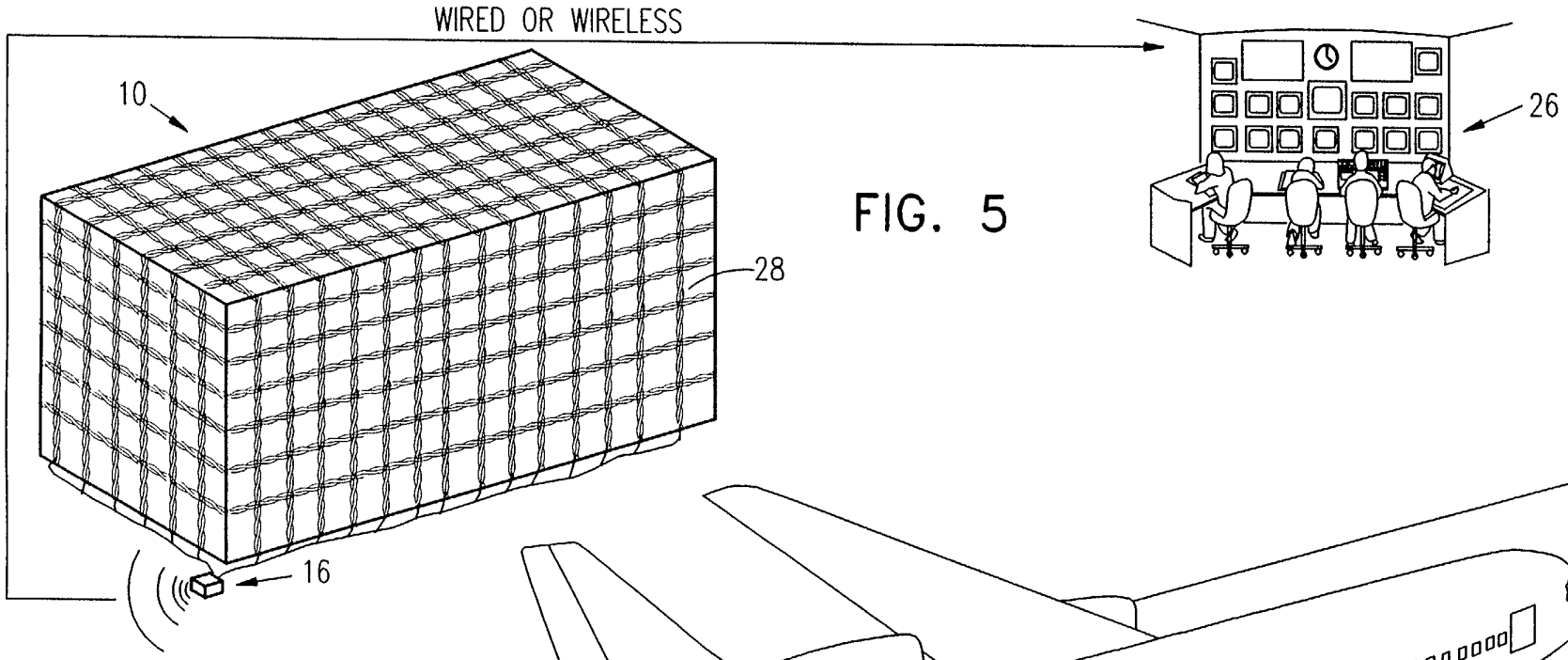


FIG. 5

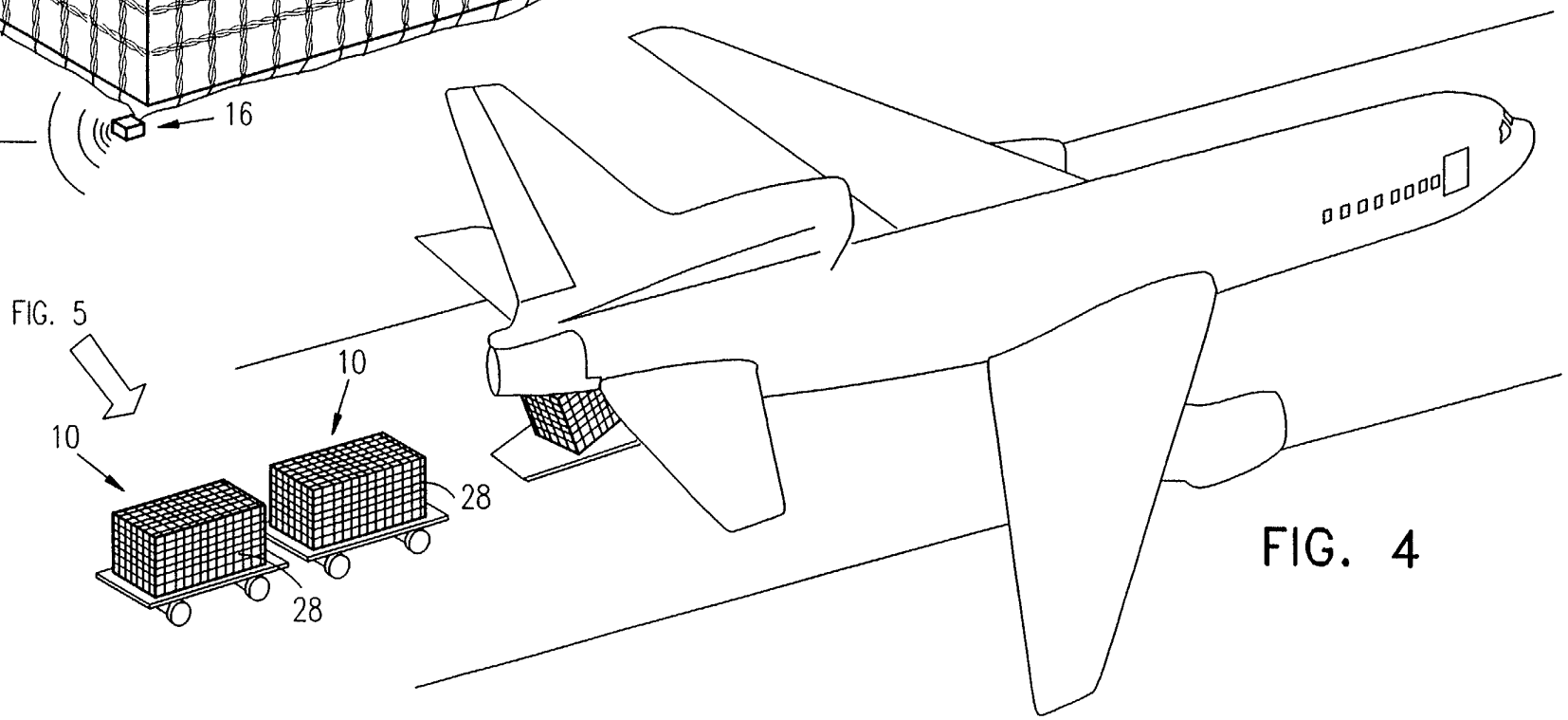
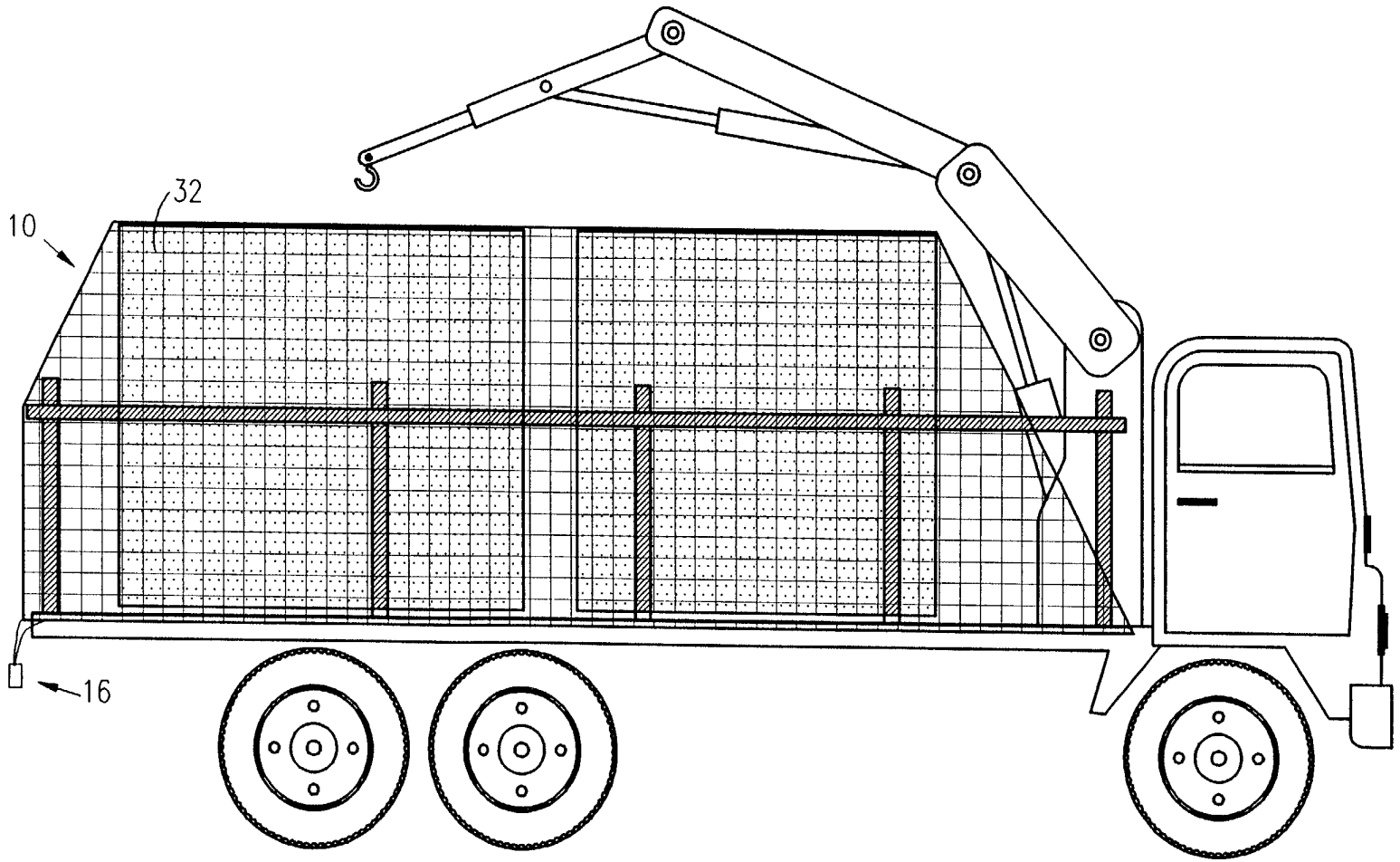


FIG. 4

FIG. 6



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UNITED STATES

PATENT APPLICATION DECLARATION AND POWER OF ATTORNEY - ORIGINAL APPLICATION	ATTORNEY'S DOCKET NO. 204,231

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name:
I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the invention entitled

(1) TITLE OF INVENTION

(1) ELECTRONIC FILAMENT NETTING

the specification of which

(2) CHECK APPROPRIATE BOX

(2) [X] is attached hereto.

[ ] was filed on _____ as Application No. _____

and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.
I acknowledge my duty to disclose information of which I am aware which is material to the patentability of this application under 37 CFR 1.56(a): the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months prior to this application; and as to applications for patents or inventor's certificate on the invention filed in any country foreign to the United States prior to this application by me or my legal representatives or assigns.

(3) CHECK APPROPRIATE BOX

(3) [ ] no such applications have been filed, or

[X] such applications have been filed as follows:

EARLIEST FOREIGN APPLICATION(S), IF ANY, FILED WITHIN 12 MONTHS PRIOR TO THIS APPLICATION				
Country	Application Number	Date of Filing (day, month, year)	Date of Issue (day, month, year)	Priority Claimed Under 35 USC 119
(4) Israel	126007	31 August 1998		☒ Yes ☐ No
				☐ Yes ☐ No
ALL FOREIGN APPLICATIONS, IF ANY, FILED MORE THAN 12 MONTHS PRIOR TO THIS APPLICATION				
(4)				

(4) COMPLETE DATA INDICATED IF APPLICABLE

I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112. I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(5) COMPLETE DATA INDICATED IF APPLICABLE

(5) _____
(Application Ser. No.) (Filing date) (Status: patented, pending, abandoned)

(5) _____
(Application Ser. No.) (Filing date) (Status: patented, pending, abandoned)

Power of Attorney: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

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Stewart J. Fried, Registration Number 20, 694
Jay S. Cinamon, Registration Number 24,156
Dennis A. Mason, Registration Number 19,571
Michael I. Markowitz, Registration Number 30,659
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Dennis A. Mason, Michael I. Markowitz,
Thomas E. Spath, Joseph J. Catanzaro
or Anthony Coppola at (212) 949-9022

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

(6) DETAILS REQUIRED FOR EACH INVENTOR

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Full Name of Third Joint Inventor, If Any	**Inventor's Signature**	**Date**
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Full Name of Fourth Joint Inventor, If Any	**Inventor's Signature**	**Date**
Residence		**Citizenship**
Post Office Address		
Full Name of Fifth Joint Inventor, If Any	**Inventor's Signature**	**Date**
Residence		**Citizenship**
Post Office Address		
Full Name of Sixth Joint Inventor, If Any	**Inventor's Signature**	**Date**
Residence		**Citizenship**
Post Office Address		